

# Teaching across the curriculum

*More than half of our secondary schools have experimented with integrating subjects at some levels, usually yr 9 or 10 (McDowall & Hipkins, 2019). Science Communicator Mike Stone explores the experiences of science teachers in three schools.*

*The Starry Night, by Vincent van Gogh, famously combines art and science; public domain.*

## Connected & Selected Learning at Rolleston College

Carolyn Green is the Science Learning Leader at Rolleston College, where the curriculum is integrated across the whole school, in two programmes. Students must take the Connected programme, then choose the courses in the Selected programs that appeal.

The Connected programme involves English, Maths, Science and Social Studies. Four teachers in two blocks teach groups of 60 students (with four or five of these groups in each year level). Pairs of teachers focus on their specialist skills (this year it is an English/Science pair and a Maths/Social Studies/Science group), and plan each theme together. Teaching is often based around inquiry or problem-based learning.

At the start of the integration process the science staff unpacked the Science Learning Area into four 'non-negotiables': Lab skills and tikanga; Scientific method; Using models and theories; and Investigating in science. These became teaching priorities, with a strong focus on NoS rather than content.

School-wide themes for the Connected

programme for year 9 are: Identity (nature vs nurture, genetics); Movement (biomechanics); Sustainability (taking action on climate change) and Innovation (space race). And for year 10: Perception (senses, illusions, light and sound); Risk (microbes); Disruption (natural disasters); Adventure (rockets).

These themes were designed with little specific input from departments, and Science teachers initially struggled with how Science would fit. However, by using the Nature of Science as a guide, teachers were able to explore their passions within science, as well as those of the students. This helped increase student and teacher engagement in authentic learning.

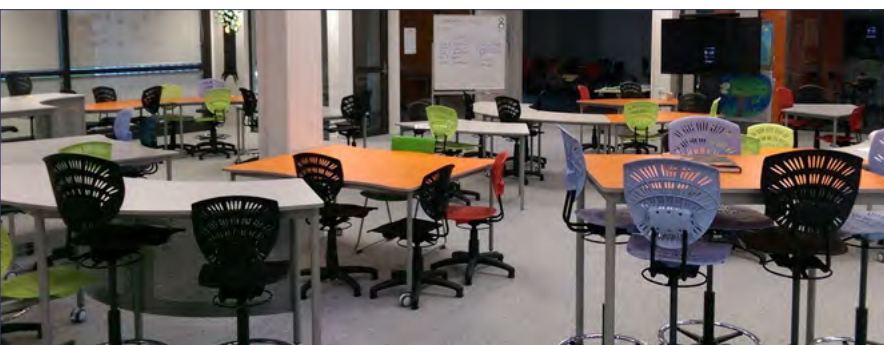
Planning is collaborative, but the teaching approach is mixed. Sometimes the two teachers share the whole class; sometimes they each take half the class and swap; and sometimes one leads and the other assists.

Assessments are also a combination of the two subjects. For example, for the identity theme this year, students explored ethical and scientific thinking around the issue of

designer babies. Field trips are also common, and are a good way to make the learning and assessment authentic.

There is also a science option in the Selected program where classes are taught by individual teachers with a focus on real-world contexts. This year students can explore science topics such as Observe the World, Proof

*Rolleston has large learning spaces with smaller break-out rooms, and four labs.*



(forensics), Mad about science, Science in the Kitchen. The selected choices change based on what students want, and teacher skills and interests.

The year 11 programme is in semesters and subjects are also taught by pairs of teachers. The assessment uses standards from each subject. For example: in the topic Over-reaction, science looks at chemical reactions and acids and bases, while Maths explores bivariate data. In Conspiracy, science explores a biological issue and English works on visual literacy.



This year is Rolleston's first year 12 cohort, which also operates in semesters. Fewer courses are integrated at this level, apart from those that logically link. For example, Clockwork Universe is a combination of Physics and Maths, and could include some Earth & Space Science.

Carolyn says this way of teaching is hard work but very rewarding. "It is great to plan together but this takes time - mostly we meet after school for a quick chat to sort an overview of what we are doing, then we plan individually and share online. Digital tools are essential because they allow communication even when we're not able to meet face to face - but the best conversations always happen first in person!"

"For the students, integrated learning is normal - many have been learning this way since primary school. Some students struggle in bigger classes, and teachers use breakout rooms for a while if needed, but parents struggle more."

"Parents sometimes find this approach without separate subjects difficult to understand and will often ask questions such as 'but where are they learning Maths, or Science?'. But with good communication and being open to answering questions they are able to see the benefit."

## Edge Programme at Edgewater College

At Edgewater College, Faye Booker is leading the Science Department's contribution to the school's work on integrating learning areas. The school wanted students to develop

21st-century capabilities - communication, collaboration, citizenship, character, critical thinking and creativity. These capabilities are the curriculum and the integrated subjects are the contexts for the learning.

In 2019 Faye was involved in the first year of their future-focussed Edge programme. The course she taught was titled Future Studies and integrated English with Science. Other courses in this programme focussed on problem-solving (Maths and Science), community action (Social Studies and Maths) and creative design (English and Technology).

The teaching pairs met once a week in a non-contact - protected in the timetable so no relief was given during this slot. In 2020 the programme has grown with one year 10 class, a year 9 class and all year 9 students completing rotations through Edge programme subjects. The school is developing bicultural capabilities for this curriculum integration as part of a Teacher-Led Innovation Fund project.

Faye worked with an English teacher in the Future Studies course, aiming to develop students' collaboration, communication, Science/NoS (socio-scientific) and English (summarising) skills. This was a mixed ability class, taught four hours a week for the year. Students had to apply for their place in this class by talking about their interests and future-focussed ideas. Each teacher taught alone once a week then two periods were taught together.

In this course students looked at:

- The future of learning - involving brain science and research, using evidence to support ideas, use of models to represent science ideas.
- The future of food - exploring solutions to meet the challenge of feeding an extra two billion people by 2050. In this socio-scientific issue students designed a future meal based on their solution
- Alternative futures - exploring utopian literature and science of genetics
- Zombie Apocalypse - exploring spreading of disease and survival, creative



communication.

Evaluation shows that curriculum integration is good for students. Students are much more engaged - they are interested, have choices and like the big ideas approach. In feedback they say they are excited by what they are learning. Faye says, "They don't ask 'why are we learning this?' - they can see the relevance of what they are learning."

The students in the first cohort opted into the programme and have choices with their learning too. Feedback says they like the collaboration and have increased confidence in communicating, especially standing up and speaking.

Students also develop creativity - they impressed their art teacher with the range of ideas they came up with. Achievement outcomes are also positive with students sitting regular school exams at the end of the year in addition to being assessed on the future-focussed capabilities.

Curriculum integration is also good for teachers - Faye enjoyed the collaboration and the freedom (what to teach, how to teach it and how to assess) and the two teachers learnt from each other. Other teachers in the programme are similarly positive and enjoy the freedom to teach to the front of the NZ Curriculum.

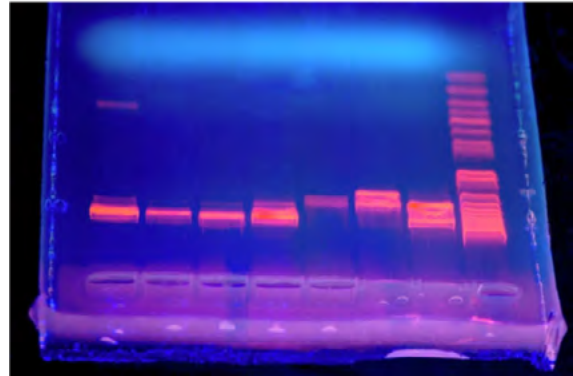
Faye advises those embarking on this adventure to "be careful to ensure we are clear in the classroom - students need to know what good quality looks like. Planning time is the key to making this work. Integrating learning areas needs support from senior leadership - here, our Principal Louise Adison developed the Edge Program and is passionate about learning being innovative and meaningful for students. Our teaching happens in traditional learning spaces. You don't need a flexible learning environment to make this work."

## Kaupapa Mata Tine: Integrated Studies at Linwood College

Helen Mora is the Science HoF at Linwood College. She gathered a group of teachers together to talk with us about their school's integrated program.

*For the genetics unit, the school borrowed a gel electrophoresis kit from the University of Canterbury and students ran a*

*gel to separate DNA fragments and analyse the results. They then discussed how this technology can be used in society.*



At Linwood, years 9 and 10 students participate in integrated units, taught by pairs of teachers covering different areas of the curriculum - English, Maths, Science and Social Studies as well as PE, Māori and technology.

Classes are organised into the school's four houses, and each pair teaches the prepared unit to a class from a different house each term, fine-tuning as they go. Topics for 2020 are listed [here](#).

***Whiria te tāngata - Weave the people together***  
*Whakatauki for Linwood's Edge integrated programme.*

These courses bring together different learning areas of the school in a way that enables students to develop a deep understanding of what can be complex ideas and skills. It also models the interdisciplinary way we experience the real world. This is the second year of integrated Studies, starting with year 9 in 2019, introducing year 10 this year and planning for integrated courses in L1 in 2021.

Angela Johnson (Science) and John Edmundson (English) are teaching a genetics ethics unit this year. They use the [Stan Walker video](#) and [The Gene Seekers](#) booklet to set the context. They plan together and each specialist teaches to their strength, with the other teacher assisting in the classroom. This blends as the year progresses.

Lessons often start with a pertinent reading, which may be science-based or not. Progress during the unit is measured using ARB tasks for Do Nows or end-of-lesson checks. The summative assessment is still being planned.

Miriam Bulger (Technology) and Olivia (Maths) are teaching a unit making, adapting and testing catapults, and will use them to destroy a castle wall at the end of the



unit. Students see a real application for their maths, the technology process and underpinning science concepts, although some still struggle with the calculations. She enjoys the delight when a student finds the factor that makes the difference between a 60cm shot and a 3m shot.

One of the positive outcomes of an integrated course was observed in a unit on Forensics (taught by Science and English) last year. In this unit students learn simple science skills - fingerprinting, chromatography and fibre examination. Their learning was brought together in the assessment when they had to present their evidence in a court case, using four suspects from the school community.

Helen said “By doing it with English we ended up with a result science could never have got by itself. The court session took three weeks, and gave the whole unit a different focus and made for rich learning. We loved it, and the kids loved it.”

There are many benefits for teachers. Nick Colville says “When we work with a teacher of another subject we learn about that subject. It’s great to work with another adult, sharing ideas, helping each other, creating lesson plans. It’s fun and the students enjoy the banter between us.” Angela Johnson says: “I can google the answer to a student question while the other teacher is leading the lesson.”

“Students find it hard at the start,” says Miriam, “getting used to this new way of doing things. But by the end of the year this integrated class is my favourite – the students are more mature and ‘integration-trained’. Students can’t tell the difference between the learning areas. But they do see the purpose of maths better.”

This group of Linwood College teachers suggests that those trying integration “need someone you can work with, time, and an ability to brainstorm ideas”.

As part of the Linwood forensics unit, students tested for mineral ions in soil samples.



Below: The students’ chart summarising different types of evidence about each suspect (photos were all of school personalities).

Forensic Test on Evidence	Suspect 1				Suspect 2				Suspect 3			
	Victim	Suspect 1	Suspect 2	Suspect 3	Victim	Suspect 1	Suspect 2	Suspect 3	Victim	Suspect 1	Suspect 2	Suspect 3
Fingerprint Comparison	X	✓	X	X	X	✓	X	X	X	✓	X	X
Shoe print comparison	X	X	✓	X	X	X	✓	X	X	✓	X	X
Microscope fibre analysis	X	X	X	X	X	X	X	X	X	X	X	X
Soil Properties	X	X	X	X	X	X	X	X	X	X	X	X
Soil acidity test	X	X	X	X	X	X	X	X	X	X	X	X
Soil Mineral test	X	X	X	X	X	X	X	X	X	X	X	X
Chromatography analysis of ink	X	X	X	X	X	X	X	X	X	X	X	X

Leo Taylor  
Liam Gale  
NYPD

## Links

- McDowall, S., & Hipkins, R. (2019). *Curriculum integration: What is happening in New Zealand schools?* Wellington: NZCER.
- [Teacher Led Innovation Fund](#)
- [Assessment Resource Bank](#)
- [Rolleston College March 2020 newsletter](#) list of yr 9 and 10 topics.

## Ngā Kupu

**Pāhekoheko** - To integrate, combine  
**Akoranga** - Discipline, subject  
**Kaupapa** - Theme, topic, programme  
**Hoahoā** - Plan, design

From Te Aka  
 Māori Dictionary



**NZASE**

New Zealand Association of Science Educators

Representing the needs of science teachers